E/ECA/TRANS/6

UNITED NATIONS ECONOMIC COMMISSION FOR AFRICA

road maintenance handbook

LC/NAIROBI

FINAL REPORT

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ECONOMIC COMMISSION FOR AFRICA

REPORT OF THE THIRD AFRICAN HIGHWAY MAINTENANCE CONFERENCE

Addis Ababa, Ethiopia
20 to 23 September 1982

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A. ORGANIZATION

1. The third African Highway Maintenance Conference organized by the Economic Commission for Africa in collaboration with the Governments of the United Kingdom, France and the Federal Republic of Germany and Socialist Ethiopia, was held at Addis Ababa from 20 to 23 September 1982.

2. The Government of Socialist Ethiopia, further organized a post-conference field trip on 24 September 1982, where participants were able to tour the Ethiopian Transport Construction Authority's equipment maintenance, material research, manpower training and maintenance district organization (Alemgena).

B. ATTENDANCE AND PARTICIPATION

3. The Conference was attended by the following member States: Botswana, Burundi, Central African Republic, the Comoros, the Congo, Djibouti, Egypt, Ethiopia, the Gambia, Ghana, Guinea, Guinea-Bissau, the Ivory Coast, Kenya, Lesotho, Liberia, Malawi, Mali, Mauritania, Mozambique, Nigeria, Rwanda, Senegal, Sierra Leone, the Sudan, Swaziland, Togo, Tunisia, Uganda, United Republic of Cameroon, United Republic of Tanzania, the Upper Volta and Zimbabwe.

4. The Conference was also attended by representatives of the following industrialized countries: Belgium, Federal Republic of Germany, France, Hungary, India and United Kingdom; United Nations bodies: United Nations Development Programme (UNDP), World Food Programme (WFP), United Nations Sudano-Sahelian Office (UNSO); intergovernmental organizations: International Road Federation (IRF) and Trans-East African Highway Authority (TEAHA); Specialized Agencies: World Bank.

C. ELECTION OF OFFICERS

5. The following officers were elected to make up the Bureau of the Conference:

1. Chairman: Ato [illegible]ta Tesfamichael (Ethiopia)
2. Vice-Chairman: Mr. Kizizie Kirenzari Apethy (Zaire)
3. Rapporteur: Mr. El Ghord Mustapha (Tunisia)

D. ADOPTION OF THE AGENDA

6. The Conference adopted the following agenda for the deliberations:

1. Opening of the Conference
2. Election of officers
3. Adoption of the agenda and organization of work
4. Consideration of the financial aspects of road maintenance:
   (a) General considerations
   (b) Economics of road maintenance
   (c) Overcoming financial and budgetary constraints

5. Consideration of the organization and management of road maintenance:
   (a) Institutional aspects
   (b) Management aspect
   (c) Staffing and incentives
   (d) Maintenance priority setting
6. Consideration of practicalities of road maintenance
   (a) Organization of maintenance equipment
   (b) Labour-based maintenance
   (c) Maintenance methods and training
7. Presentation of the ECA Road Maintenance Handbook:
   (a) Vol. I maintenance of road side areas, drainage structures and traffic control devices
   (b) Vol. II Maintenance of Unpaved Roads
   (c) Vol. III Maintenance of Paved Roads
8. Other matters
9. Date and place of the fourth African Highway Maintenance Conference
10. Adoption of the report
11. Closure of the meeting

E. ACCOUNT OF PROCEEDINGS

I. Opening of the Conference

7. The meeting was officially opened by the Minister of Construction of Socialist Ethiopia, who welcomed participants on behalf of his Government. He stated that African countries had accorded very high priority to the expansion of transport infrastructure as a promoter of collective self-reliant and self-sustaining development and the economic integration of the continent. The United Nations Transport and Communications Decade and the Lagos Plan of Action would not be realized without an adequate transport system in general and road network in particular. Roads, he continued, were versatile, entirely self-sufficient and the most practical mode for Africa, although the fragmented and under developed African road systems needed to be inter-connected to provide an adequate trans-African network.

8. He recalled the recently conducted ECA/World Bank/Ethiopia seminar on road maintenance, which had brought out the need for improved maintenance management throughout Africa. The Minister said his country was fully committed to the improvement of road maintenance operations, equipment, finance and training.

9. He then recalled the provisional agenda of the meeting which had provided the opportunity to discuss such crucial issues as road maintenance financing and economics, organization and manpower development, and equipment and material resources. He also recalled the ECA Road Maintenance Handbook which was to be thoroughly reviewed by participants during the Conference, and would hopefully improve the African road network.

10. Finally, the Minister thanked Professor Adebayo Adedeji, United Nations Under-Secretary-General and Executive Secretary of ECA for the steps he had taken in organizing the Conference, and also the sponsoring Governments. He then declared the meeting open.

11. Professor Adebayo Adedeji, United Nations Under Secretary-General and Executive Secretary of ECA in his welcome address thanked the Government and people of Socialist Ethiopia for hosting the Conference and expressed special gratitude to the Governments of France, the Federal Republic of Germany and the United Kingdom for their invaluable financial and technical assistance in organizing the Conference, and in producing the ECA Handbook for Road Maintenance in Africa.

12. He pointed out that the regional conference was immediately following a successful joint ECA/World Bank road maintenance seminar for the Eastern and Southern African subregion and stressed that that was adequate manifestation of the seriousness ECA and African countries attached to the maintenance of and preservation of the investments in road infrastructures. Two previous regional conferences had been held in 1974 in Addis Ababa in 1977 in Accra and a further subregional conference was planned in Abidjan the following year with the collaboration of the World Bank and the African Development Bank. He indicated that the planned subregional conference would enable indepth discussions of selected maintenance issues and involve high-level decision-makers from the finance and planning ministries.

13. He informed the Conference that the first regional conference in 1974 had considered all the complex issues of road maintenance, such as methods, assessing needs, cost reductions, interaction of maintenance and construction standards, environment, destructive effects of neglect of minor but vital items such as ditch cleaning and the need for good route alignment and adequate construction standards. The conference had concluded that road maintenance required indepth and constant research in appropriate technology, indigenous construction materials, proper technical training and collection and dissemination of maintenance costs and research results. The second regional conference had similarly deliberated on the above issues and above all, pointed out the lack of maintenance handbooks and manuals in Africa and had requested the ECA Executive Secretary to approach the sponsoring Governments of France, the Federal Republic of Germany and the United Kingdom to assist in the preparation of such handbook and manuals suitable for Africa.

14. He was pleased to inform the Conference that the three Governments had prepared the handbooks after consulting ECA and African countries, and that the books would be distributed to all participants. He urged that the handbooks be put into practical use.

15. In presenting the agenda for the meeting, the Executive Secretary pointed out that maintenance was not a glamorous task and usually receives little budgetary allocations as compared with new construction and warned participants the challenge to them was selling the idea and advantages of adequate and proper maintenance which was actually a cost saving to the nations. They were also to consider real budgetary constraints, foreign exchange outlays on maintenance; and proper organization, management and administration of road maintenance.

16. He briefly described the contents of the three volumes of the ECA Road Maintenance Handbook and concluded that although the handbook was primarily designed for maintenance foreman, it was equally useful as reference manual for engineers responsible for the proper maintenance of roads.

17. In conclusion he urged participants to carefully consider the aspects of equipment, spare parts, training, labour-incentive methods, maintenance contracting and research and development. Maintenance was a very complex operation and unless properly organized, programmed and well executed, the cost to national economies would be enormous and urged participants and African countries to closely co-operate with industrialized countries and agencies in examining all aspects and advancing rational solutions for road maintenance in Africa.

18. The Ambassador of the Republic of France in his statement thanked the Executive Secretary of the Economic Commission for Africa for organizing the Conference and inviting him to attend.

19. He emphasized the size of the French delegation which was composed of eminent road maintenance experts. The wealth of experience of the experts provided visible evidence of the importance that his Government attached to co-operation among developing countries. France's assistance to developing countries would be increased to 0.7 per cent of its GDP regardless of the world economic situation. (In 1982 French aid amounted to 0.52 per cent of GDP).

20. In that connexion a ministry of co-operation and development had been established whose main activity would be to fulfil the solemn commitment made by the President of the French Republic.

21. The French delegation would actively participate in the Conference and support its decisions and resolutions. The delegation would also contribute to the implementation of the national or international highway programmes which would be carried out under the auspices of the Economic Commission for Africa.

22. In his address, the Ambassador of the Federal Republic of Germany commended the Executive Secretary of ECA for his stimulating opening address, and for his vigorous support of every aspect of the Transport and Communications Decade in Africa (UNTACDA) which he had witnessed on a number of occasions.

23. The very fact that a third conference had been organized, and the impressive size of attendance of delegations from all over Africa and elsewhere underlined two very encouraging points. Firstly, he said, when it came to road construction and maintenance, Africa did not evidently encounter any problem in attaining a quorum; and secondly it emphasized the degree of importance rightly attached to ensuring proper maintenance not only of the national networks but also of those roads leading to neighbouring States which are vital for the development of the continent's immense potential.

24. He again thanked ECA for providing the opportunity for the discussion and exchange of experiences on the real problems of maintenance, the training of professional personnel, and the state of research in the field. Road maintenance was expensive, he continued, but lack of maintenance cost even more. Proper maintenance actually saved money, and set free resources badly needed for new construction. Considerable efforts had been made both by individual African road administrations and by the three sponsoring nations to implement the Transport and Communications Decade. The sponsors readily responded to African calls during

the second Conference in Accra in 1977, and provided both technical and financial support to produce the Maintenance Handbook. He paid tribute to his Franch and British partners of the tripartite venture for the splended spirit of co-operation that had prevailed throughout the period of preparation of the handbook.

25. Had his country had a similar manual during the 30s, 40s and 50s when Germany had developed its road network, it would have been a great deal better off. The handbook was most practical to apply to Africa, he said, and could be effectively applied to such projects as 400 km of a new road section recently built by Ethiopia as a segment of the Cairo-Gaborone Trans-East African Highway with some assistance from his country.

26. He said that preparing the German part of the manual, Volume I, for which his country had mobilized experts from several ministries and institutions, the best his country had, provided a practical example of an effective transfer of technology to Africa.

27. In his address the British Chargé d'Affaires expressed his Government was pleased to have co-sponsored the Conference and co-produced the handbook with his French and German colleagues. He thank ECA for its excellent co-operation; and the participants for their keen interest in the Conference.

28. He briefly stated that his Government's aid strategy was aimed at the industrialization of African economic development to enable stable world economic growth, and although his Government was exercising strict control of its expenditure it nevertheless was the fifth largest OECD aid donor in 1981. British assistance included financial aid, technical co-operation, training and education and British aid for 1982-1983 would amount to £61,091 million, a substantial part of which was earmarked for Africa on bilateral and multilateral basis.

29. The British Government's Overseas Development Administration (ODA) had long recognized the problems of road maintenance and had carried out many road construction and rehabilitation projects in Africa in addition to other project packages with built-in road components.

30. The Chargé d'Affaires informed the Conference that his Government was party to a World Bank aid accord which in principle urged financing of road maintenance and other recurring costs, such as spare parts, equipment and training components. He pointed out that it was a result of the unique research carried out by the Transport and Road Research Laboratory (TRRL) which demonstrated the enormous economic benefits accruing from proper road maintenance and resulted in the current interest in maintenance. TRRL's work covered many aspects of transport research and much of its overseas work was carried on in collaboration with research workers in developing countries. The results were available free of charge to anyone interested and involved in transport development.

31. In conclusion he pointed out that the United Kingdom, France and the Federal Republic of Germany were the largest donors to the European Development Fund (EDF) and that £69,800 million had been for Lome II. He was pleased that the three countries had collaborated in preparing and presenting 20,000 copies of the road maintenance handbooks to ECA which would contribute to the improvement of road maintenance in the continent.

32. In his address the Vice-President of the International Road Federation expressed his gratitude to the ECA Executive Secretary for having taken the excellent initiative of organizing the Conference in such a beautiful city as Addis Ababa and that it was well to remember that it was in Addis Ababa that the first African Highway Conference was held in 1969, organized by the International Road Federation in collaboration with the United Nations, the Organization of African Unity and the Ethiopian Government. Since 1969, Conferences had been held in Rabat, Abidjan and Nairobi, and furthermore, the International Road Federation, at the invitation of and in collaboration with the Government of Gabon, was organizing the fifth African Road Conference to be held in Libreville from 6 to 11 February 1983.

33. He continued that it was certainly necessary, in a continent such as Africa, to carry out at an early stage, under the best conditions and as quickly as possible, a coherent, adequate and completed network of intercontinental roads in Africa and to consider and study links with neighbouring continents, Europe and Asia.

34. He continued that it was becoming more evident that particular and very careful attention needed to be paid to the maintenance problem of each African country, and that the International Road Federation had long realized the need as well as the difficulties of that task.

35. It was for that reason that IRF had set up within its organization a working group, of which Dr. Marini had the honour to be President, which was specially charged with the problems of road construction and maintenance.

36. The working group was drawing up a list of needs on the subject of maintenance in each country, in particular in the developing countries, and that a list of specific African needs regarding the matter would be sent to the International Road Federation which would use all its efforts and experts to work in finding solutions on the technical, economic and financial aspects of these questions.

37. Furthermore, he said that the problem of maintenance represented one of the most prominent subjects to be discussed at the fifth African Road Conference in Libreville. He concluded by offering his sincerest wishes for the complete success of the Conference.

38. The Ambassadors of the three sponsoring nations then presented sample volumes prepared by their respective countries to the Executive Secretary of ECA.

Technical description of the Conference

39. A member of the ECA secretariat, in a brief outline of the technical content of the Conference, said that due to the gravity of the maintenance problem, it had been necessary to organize a regional Conference right after the completion of a most successful road maintenance seminar concluded a few weeks earlier.

40. The Conference would consider the economic and financial aspects of maintenance as well as organizational and management problems African road administrations faced. Participants would also exchange experiences and opinions on maintenance priorities, staffing and incentives, training needs; and labour and equipment.

41. Knowledgeable world authorities and expert resource personnel had come primarily in the form of high-powered delegations from the sponsoring countries, Britain, France and Germany. Experts from the World Bank, the International Road Federation, Belgium and India have also come with a wealth of knowledge and experience.

42. One of the main features of the Conference he said, was the presentation of a maintenance handbook particularly designed for the African terrain and environment, and participants were expected to examine all three volumes in some detail.

43. Another important feature of the third African Highway Maintenance Conference was the time set aside for African participants to present their maintenance problems for a wider exchange of experiences, not only on the problems, but, most important, on the solutions each country has found.

44. The ECA representative then provided participants with further information of an administrative nature, regarding banking, travel and postal facilities available around the Conference premises.

Consideration of the financial aspect of road maintenance

The cost-effectiveness of road maintenance (United Kingdom paper)

45. The three main purposes of road maintenance were:

(i) to reduce the rate of deterioration and to prolong the life of the roads

(ii) to lower the cost of operating vehicles by providing good running surfaces;

(iii) to keep the road open on a more continuous basis.

46. Examples were given to illustrate the potential benefits that could be obtained from each of these items.

47. An expenditure of $11,500/km over five years could defer a rehabilitation cost of $60,000, giving a cost/benefit ratio of over 4:1.

48. Vehicle operating cost accounted for 80 per cent of the costs associated with a well-maintained road over its design life. Maintenance costs were approximately 1 per cent of the total cost. If the road is allowed to deteriorate through lack of maintenance, vehicle operating costs can rise by approximately 15 per cent. If the surface of the road is allowed to disintegrate, vehicle operating costs rise by approximately 50 per cent. The potential benefit from savings in vehicle operating costs is of the order of 40:1.

49. These increases in vehicle operating costs were all spent on fuel, tyres and spare parts which result in a large drain on the foreign exchange resources of a country.

50. If lack of maintenance results in roads being cut, there can be a breakdown in economic activity resulting in high costs to industry and agriculture.

51. The following priorities for national budget allocations in the roads sector were recommended:

1. Maintenance
2. Upgrading and strengthening
3. New investment

Finance and budgetary problems (World Bank presentation)

52. Following the road construction boom of the 1960s and 1970s, African countries were now heading for a major crisis in the 1980s and 1990s because of inadequate road maintenance. The World Bank undertook a major review of road maintenance resulting in the publication of "The road maintenance problem and international assistance".

53. Six possible ways of financing road maintenance were discussed:

(i) Reallocation of resources from other sectors: This was unlikely to happen in the future and the roads sector will probably have to manage with fewer resources than in the past, rather than more.

(ii) Increase in road user estimated taxes. These are already set at high levels in many countries, but there is perhaps need to increase taxes on heavy vehicles taking account of the number of wheels on the vehicle which are carrying the load.

(iii) Reallocation of existing highways budgets: The economic returns on new construction are of the order of 10-30 per cent whereas, for maintenance, they are usually in excess of 100 per cent. Only after the maintenance needs of the existing network have been met can new additions to the network be justified economically. Both road departments and loan agencies are guilty of creating economic distortion by spending too much on construction and not enough on maintenance.

(iv) Local self-help : Local communities benefit from rural roads and measures must be taken to assist those people with the maintenance of roads by providing technical assistance to enable them to carry out the maintenance themselves.

(v) Improvement to efficiency and quality control : These are needed for both new construction and repair. Poor utilization of both equipment and labour are common in road maintenance activities.

(vi) International assistance : The lending policies of many donors have been liberalized to allow funding, not only of periodic maintenance, but also, in exceptional cases, of a decreasing share over time of recurrent costs. Donors will continue to fund the capital requirement of maintenance works, but rules for funding of equipment will be tightened up. In the past, funding has been readily available and this has resulted in poor incentives for good utilization. Additionally, in the future, the World Bank will fund rehabilitation in cases where reasonable and timely maintenance has been carried out.

Increase in the economy of road maintenance efforts by using local road material (Federal Republic of Germany paper)

54. One way of reducing road maintenance costs is to make more use of locally available road building materials. The high cost of quarrying, processing and transport have made traditional materials very expensive. Local materials should be used for road building wherever their suitability can be demonstrated.

55. Standard engineering tests and design methods are often not appropriate for local materials and insistence on these standards often precludes the use of such materials. Special tests and design methods needed to be established.

56. The "equivalence principle" method for pavement thickness design was recommended. Examples were given of its use in both pavement design and strengthening applications. Using this method, it is found that layers constructed with local materials need to be approximately 20 per cent thicker than conventional materials, so they need to be 30 per cent cheaper than conventional materials in order for there to be a benefit.

57. This method of design had not yet been tested in the field and full-scale trials needed to be established.

Road network maintenance and its impact on staffing, equipment and running cost requirements for highway authorities (Federal Republic of Germany)

58. Detailed recommendations were made for carrying out certain maintenance operations. Maintenance works can be divided into different groups of depending on whether they are carried out on or off the carriageway, depending on the type of construction and depending on whether the activities are routine or periodic.

59. The use of labour was recommended for maintenance particularly for works outside the carriageway, until wage rates increase to a level where they are uneconomic. Grading and dragging could only be carried out mechanically, but the machinery could be quite simple. However, they must be carried out regularly to be effective. Resealing operations should be carried out by local contractors wherever possible.

60. The number of "maintenance units" that were needed had been determined for a sample district in Botswana, and maintenance costs had also been determined.

61. It was pointed out that insufficient maintenance funds were usually budgeted for and that these funds were then cut. If funds were cut, the frequency of regravelling could be reduced. Bituminous patching should still be carried out, but resealing could be deferred. If a minimum-maintenance policy is adopted, the work must be planned very carefully.

62. Reductions in maintenance expenditure are possible from a technical point of view, but because of the resulting high vehicle operating costs, reductions are not considered economically viable. Examples of maintenance costs should be used to advise both ministers and donors of the cost requirements in the future for every new length of road built.

Country report

63. Central African Republic (CAR), the representative of the Central African Republic described his country's road network and also outlined its organization for road maintenance. The Central African Republic found that the maintenance of unpaved roads was particularly troublesome and costly, and believed that many of its roads should be paved.

Discussion "A"

64. In response to a question from Sierra Leone, the World Bank representative said the Bank did not wish to advocate the use of computer models for maintenance planning where simpler methods were available. Computer models should not be used to solve practical problems, but can be used as a weapon to obtain greater budgetary allocations. The Bank was moving in the direction of only funding rehabilitation where satisfactory maintenance had been demonstrated. Funding would be concentrated on periodic maintenance and strengthening as those were more cost-effective. The representative of the Bank then answered a question from Nigeria by saying that maintenance should be given priority from an economic point of view, but political and social considerations also had to be taken into account. The penalities of not providing adequate maintenance were a drag on countries' economies. Major distortions were being introduced in countries' economies because of funding within the roads sector. He stated that there was a need to tax heavier trucks more severely, but that this did not necessarily require the earmarking of taxes, which had sometimes not worked very well. Answering several questions from Belgium, the representative of the Bank said that because of competitive pressures in the trucking industry, the costs of additional taxation would have to be passed on to the consumer.

65. Because of this, governments had to decide whether they wished to subsidize the trucking industry or the roads sector with their taxation policy. The representative of the World Bank said that, at the moment, it had no model system for axle load control but recommendations would be made in a forthcoming report on energy taxation. The question of whether transit vehicles should be taxed was political rather than economic and there was little that the Bank could contribute to this debate. Heavier taxes would help to generate funds to strengthen the road network for the long term. Better use could be made of import control and public education programmes in this field.

66. The representative of Mali complained that there was a problem of roads deteriorating during the period that loans took to approve. Additionally, assistance was needed for research into the use of local materials. Better specifications were needed to reduce the deterioration of bad roads and more productivity was needed from manual labour. The representative of the Federal Republic of Germany claimed that it was unrealistic to tax truckers to such an extent that they paid for all the road damage and that a compromise always had to be found. In India, maintenance funds come from a different source than those for construction. The Indian representative believed that engineers had a duty to advise politicians of the need for maintenance. Botswana was carrying out a research study to look at the suitability of low-grade local gravels. It had found with road trials that those materials could be used and suitable specifications were being devised. In addition, both fixed and portable weigh bridges were in use to control overloaded vehicles. It had been found that both national and transit traffic were offending. The representative of Burundi said that there was a need for the World Bank to provide a "package deal" to fund not only equipment but also fuel and spare parts.

67. The representative of the World Bank stated that the Bank lends for initial stocks of spare parts for periodic maintenance. Where IDA credits were concerned, it was possible to fund recurrent costs for routine maintenance diminishing with time, but only where the recipient government has introduced a new policy to place emphasis on road maintenance. In reply to questions from the representative of the Gambia, the representative of the United Kingdom said that the vehicle operating costs quoted were mean values measured over a range of driver behaviours. More recent research had shown that fuel consumption started to increase when roads started to form pot-holes, He indicated that it was for national governments to decide on their own budgetary policies for road maintenance, the speakers could only point out the consequences of different budgetary policies. It was also pointed out that high cost construction does not result in nil maintenance, and that if drainage maintenance and resealing were neglected, this would only result in the loss of an even larger investment.

Organization of road maintenance (France)

68. Road maintenance should be streamlined in order to attain the objective of preserving road capital and maintaining a minimum level of service. Five themes are developed:

(a) The need for permanent access to comprehensive network data comprising administrative and technical classification of roads, detailed inventories, traffic and environmental data;

(b) The need for clear assignment of such tasks as planning, implementation and monitoring among the various services so as to define their responsibilities well;

(c) The need, in order to successfully perform such a diversified task as road maintenance, to define a coherent policy based on quality standards and a quantification of the tasks involved, so as to make it possible to define priorities, distribute resources and monitor implementation;

(d) The need for medium- and long-term planning which should determine foreseeable needs and enable the administration to cope with them (as in the hypothetical example given) and for short-term programming making optimum use of available resources;

(e) The need for financial control and the establishment of an analytical system of accounting that would provide such administratively and statistical useful data as costs, returns and utilization dates.

69. From a rational point of view, road maintenance requires high calibre engineers and technicians; it is clearly as important as road construction itself.

Organization and management of maintenance (United Kingdom)

70. Some of the broad issues which affect the way that maintenance is organized and managed were discussed.

71 The need was stressed for maintenance to be carried out by an autonomous department in order to ensure a secure budget.

72. It was recommended that the responsibility for organizing maintenance should be delegated to the lowest possible level and that this should be limited only by the availability of trained staff and the smallest size of viable operating unit.

73. Comments were made on the usefulness of management systems and that if these were adopted they should be appropriate, simple, easy to use and introduced gradually.

74. The use of direct labour (forse account) and contractors for carrying out maintenance were discussed and it was suggested that more use could be made of local contractors for both routine and periodic maintenance.

75. The need for a well founded and funded equipment organization was stressed and that organization should hire out equipment to the maintenance organization on a repayment basis. However, that required additional management skills which were in short supply. The problems of using equipment for maintenance were mentioned and it was suggested that there was probably more scope in many countries for using labour-based methods.

Management problems of road maintenance projects, the German experience (Federal Republic of Germany)

76. Lack of maintenance primarily was lack of management. Management meant responsibility for the result, i.e., the number of well-maintained kilometres of road.

77. Management strategy of Germany meant tackling the most crucial issue of the whole problem as demonstrated by the following three projects:

(a) Bosembele-Garoua Boulai (444 km) earth road in the Central African Republic:

(i) Main problems:

1. There was no distinction between maintenance and rehabilitation;

2. Reactivation of administration in the short run was not possible.

(ii) Main management objectives:

1. Ensuring that the transit traffic is carried out all year round;

2. Forming a medium-heavy repair unit instead of two light maintenance units;

3. Carrying out of the maintenance by a private construction company (including duty-free import of the construction machinery, free supply of petrol from neighbouring countries);

(iii) Costs: Ratio of manual maintenance against mechanical maintenance is 1:3. Approximately 70 per cent of the combined manual and mechanical maintenance is to be paid by foreign exchange.

(b) Maintenance of asphalt roads (300 km) in northern Cameroon:

(i) Main problems:

1. Lack of foreign finance for asphalt maintenance;

2. Lack of local experience in the "subdivisions";

(ii) Management strategy:

1. Executing a demonstration phase (including shipping, production, setting up mobile bridges and operation fund);

2. Subsequent training of staff on the site and introduction of pertinent administrative regulations;

3. Withdrawing of the Europeans gradually and placing them only in an advisory capacity.

(c) Maintenance of the Juba-Wau gravel road in the southern Sudan:

(i) Main management objectives:

1. Financing construction and maintenance (for approximately five years) at the same time;

2. Taking over the best of the workers of the construction phase into the permanent jobs of the maintenance phase;

3. Setting up an additional manual maintenance programme together with the establishment of local road camps.

78. Conclusions:

(a) Financing institutions must provide for an "after-sales-service" of their new road constructions for the first five to 10 years of maintenance requirement (i.e. an increase of total project funds by approximately 25 per cent);

(b) Staff problems for maintaining new roads should be solved by retaining the trained staff of the construction phase;

(c) To alleviate the burden of the administration, maintenance of existing roads should also be given to private contractors as far as possible;

(d) Financing maintenance of existing roads should be secured by a road maintenance tax (approximately $20.00 cents/litre of petrol) channelled directly into a special road maintenance fund's;

(e) The low reputation of road maintenance in many countries seemed to be the basic aspect which over-shadowed all rational considerations. A breakthrough of the vicious circle of tour prestige, low pay and low performance should be initiated by the international opinion leaders (financial agencies, etc.), so that the individual African countries may follow suit.

Country paper

79. United Republic of Tanzania, the United Republic of Tanzania is a large country with a dispersed population. It had 45,000 km of roads of which only 7 per cent was paved. It had 10,000 km of trunk roads. The country had been the recipient of a two-phase World Bank project for road maintenance aimed at constructing and improving road camps and workshops and for the implementation of training schemes. A separate Trunk Roads Maintenance Organization was established with headquarters staff and regional engineers. Each of those has an expatriate counterpart.

80. In the first phase, there had been major problems of equipment utilization, of expatriates adapting to local conditions and of inadequate local budgetary allocations. Attempts were being made to solve these problems in the second phase.

As a result, the Government had pledged not to divert equipment from road maintenance and expatriate staff were now firmly established in the regions. The World Bank was now considering a third phase to include rehabilitation of equipment and more training.

81. There was an additional problem with the maintenance of urban and rural roads. Some assistance with maintenance had been obtained for the Municipality of Dar-es-Salaam, but there was a great need for assistance from international agencies for the rural roads where most of the population actually live.

82. Kenya has 3,500 km of classified roads plus an extensive network of rural access roads giving a total network of 40,000 km to be maintained by central government. Since independence the roads budget had only slightly increased although the length of the network had increased by a factor of six with the result that maintenance had been neglected in many cases.

83. Under a sector loan in 1978, a major review of the network was carried out. As a result, a cost accounting system had been introduced. That system included components for monitoring, reporting and accounting which were described. The system allowed feedback about road maintenance activities in monitary terms which encourages a more cost-conscious approach to maintenance. It was simple, required a minimum of training and provided only that information required by management.

84. India has 1.2 million km of roads of which approximately 10 per cent are main arterials. There are now 3.7 million vehicles using these roads. Axle loads have increased considerably and 25 per cent of trucks have axle loads of 20 tonnes.

85. The maintenance budget was separate from construction funds and was not transferrable, but the allocation usually fell below the requirements. Maintenance does not include strengthening or upgrading. Requirements for funds are assessed using maintenance norms. A maintenance manual for districts which will outline the various maintenance techniques is under preparation.

86. A national seminar on maintenance was recently held and recommendations were made to:

(i) provide proper funding for maintenance;

(ii) provide incentives for staff;

(iii) standardize assessment criteria;

(iv) improve the construction and maintenance of drainage.

Discussion

87. The representative of the World ORT Union felt that enough had been said about the problems and that it was now time to look for the solutions. One problem was that engineers are only trained in design and construction and that an engineer working in maintenance was unable to use that experience to qualify professionally. Professional training for maintenance needed instituting. The need for training required taking into account at the project planning stage and training for new equipment must be carried out before that equipment was delivered. It was suggested that the use of contractors for maintenance would do little to solve manpower problems and that it was always difficult to transfer construction skills to maintenance work. Technical training in Africa was generally good, but the management of that training was often poor. The representative of France agreed that while there was little training carried out for engineers in maintenance there was also a need for management training. The representative of the World Bank pointed out that extensive use had been made of contractors for periodic maintenance, but there was now some experience of their use for routine maintenance in six countries. The use of contractors for maintenance would probably be an increasing tendency particularly where there are problems of retaining staff or providing incentives. The representative of the Gambia stated that it was not possible to manage without resources. The main problems of African countries were low pay and bureaucratic processes. The best people were not being attracted to maintenance because of lack of prospects. Donors must always fund maintenance to follow on from construction projects. The representative of Nigeria agreed that one could not manage without resources, but said that engineers must not be trained for maintenance alone. A further problem was that there were often long delays between project identification and execution by donors and, as a result, rehabilitation instead of maintenance was needed. The representative of the Federal Republic of Germany stated that engineering courses in Africa often used curricula borrowed from the industrialized countries. That resulted in only design and construction being covered, with nothing on maintenance. The main need was for on-the-job, in-the-mind training rather than classroom training. There was a social problem of people being trained centrally in the capital who then were reluctant to work in the field and that was one reason why expatriates were recruited. The cost of those expatriate advisers was too high and ways must be found of reducing it. There was a need to differentiate between loan and grant funding when paying for experts. If contract maintenance was used, then there was a need for longer contract periods of at least four to five years. In Kenya, the maintenance engineer is in a more privileged position than the construction engineer. Maintenance engineers were better paid and had more prestige than others. There were many applicants from engineers in design and construction for jobs in maintenance. In Lesotho the policies of donors led to problems of standardization of equipment. It was also recommended that the equipment organization should be placed within the roads department, rather than having to service the whole of government. Zaire used constructors for maintenance because the Public Works Department was usually more interested in new construction. There was also a need for the decentralization of maintenance and ways of funding the recurrent maintenance expenditure, perhaps through a fuel tax, were being looked into. A manpower department had been formed in the country and donors had provided new workshops. In that country, all engineers were involved in maintenance they were well paid and there was no problem about

engineers not wishing to return to the field after training. An attempt was being made to make more use of the rural population for construction. The World Bank was asked to encourage research into social materials and also to take account of trials already carried out when setting standards for new jobs. There was also a need to look at roads and road transport as a package, particularly including overloading, and not just at maintenance.

Central Highway Laboratory (France)

88. The statement explained the methods and resources used in France to carry out studies on the improvement and maintenance of roads. Road improvement studies were effected on road deflections measured with deflectographs and visible deterioration. The studies were in two phases: an overall assessment which defined requirements and established priorities and a pathological analysis on each selected route. Sizing was done with a technical manual which was now being adapted for use in developing countries. Preventive maintenance studies were based on the performance of structures and road surface characteristics over time. After the zero point, roads were systematically monitored and then diagnostic studies were made on the weak sections. High-output diagnostic equipment was used. The technical manual for preventive maintenance set out the approach to be used in the studies.

The role of public works laboratories in improving road maintenance (France)

89. The laboratory plays a crucial role in maintenance and reinforcement studies. It is involved in all stages of a project. Vigilance is its watchword during such phases as study, monitoring establishment of ground zero for a roadway and training. Its approach should be preventive maintenance in considering the status of road networks, and remedial work in initiating maintenance operations. It should share its experience by advising all those concerned and finally use its research results to help to make savings and promote technological progress.

Methods for the determination of road maintenance priorities (Federal Republic of Germany)

90. The report highlighted the state of the art in OECD countries as described in reports from various sources. It was pointed out that many countries are striving for pavement management systems. However, very few countries so far have adopted such systems for general use.

91. Systematic and regularly repeated assessment of road conditions, translating this information into maintenance requirements, and the subsequent determination of maintenance priorities is a precondition for good maintenance planning and execution. Equipment-based objective measuring procedures being described by the representative of France, the report focussed on subjective assessment methods such as systematic visual inspection and the use of rating methods. Examples of various methods used in a number of countries were given, the objective of the report being to encourage the implementation of simple and inexpensive methods in existing maintenance services without absorbing resources in personnel and budgetary means urgently needed otherwise. Those methods left ample space for adaptation to particular conditions, situations, objectives, facilities and to different levels of service desired for various classes of roads.

92. The steps to be taken were:

(a) Establishment of a catalogue of road deficiencies by categories of types and severity;

(b) Estimation of repair costs for each case established;

(c) Inspection of the road in order to:

(i) classify road conditions according to pre-established scheme; and

(ii) to localize homogeneous sections;

(d) Consideration of traffic studies (volumes);

(e) Establishment of an order of priority according to the classification of homogeneous road sections by severity of deficiencies and volume and type of traffic;

(f) Estimation of repair or maintenance costs for each homogeneous road section;

(g) Definition of a realistic programme related to the funds available.

93. Economic aspects which can and should be considered additionally, have not been considered in this report.

The "TRRL" Overseas Road Note 1" method for setting maintenance priorities (United Kingdom)

94. Three steps were needed in the practical management process:

(i) Assessment of requirements: establishing what needs to be done in physical terms;

(ii) Allocation of resources: estimating the men, machinery and materials required for each task; determining priorities and allocating resources to obtain the most cost-effective results;

(iii) Monitoring: checking that the completed work has produced the desired results.

95. A simple method of setting priorities for road maintenance was described which made use of information obtained from road inspections, a knowledge of the nature and amount of traffic using each road, and knowledge of the soils, terrain and climate.

96. A working group of the OECD road research programme prioritized by Belgium hosted two missions.

(a) A survey questionnaire was sent to developing countries. Nineteen African countries participated in the survey. A summary of the survey had been prepared and would soon be published.

(b) A report was currently under preparation for the use of managers and engineers.

Conclusions

(a) While the maintenance of unsurfaced roads involves no substantial expenditure the funds should be provided regularly and on time;

(b) Allocating such funds require an updated inventory of the road network and its condition. Deterioration should be catalogued and traffic statistically recorded.

Country paper

Belgium, maintenance of unpaved roads

97. The Belgian representative referred to the maintenance of unpaved roads, and described the work of an OECD Working Group that is preparing a synthesis on the maintenance of unpaved roads in developing countries. He pointed out that numerous countries in Africa, Central and Southern America and Asia have a very large network of unpaved roads, often more than 80 per cent of their entire road networks. Unpaved roads are susceptible to rapid deterioration, and hence maintenance work should start as soon as construction ceased. However in many countries the maintenance activities are not sufficient to prevent deterioration of the unpaved roads. There are many causes for this, common to several countries. For example:

(i) insufficient funds are provided;

(ii) construction standards are too low;

(iii) inadequate materials are all that are available;

(iv) there are shortage of equipment and spare parts;

(v) information on traffic is lacking;

(vi) axle loads are too high;

(vii) failure to respect road closures during the rainy season;

(viii) maintenance personnel are not properly trained;

(iv) there is no hard and fast maintenance policy.

98. The OECD Working Group prepared a questionnaire on the maintenance of unpaved roads which was sent to 107 countries, including 84 developing countries. From the replies the Working Group had formulated a report, which had the following conclusions:

(i) the maintenance of unpaved roads, which represent two thirds of the roads in many developing countries, does not require a very high expanditure but funds have to be provided on a regular and perpetual basis;

(ii) a proper inventory of the unpaved road network is essential if good decisions are to be made about the allocation of available funds for maintenance;

(iii) there is a need to develop appropriate technologies and methods for the maintenance of unpaved roads in developing countries;

(iv) the dissemination of appropriate technical information on the maintenance of unpaved roads needs to be improved, and the training of personnel and regional co-operation should be given special attention.

99. The report of the OECD Working Group, which is aimed at engineers, will be published shortly.

Ethiopia, the effect of budget and other constraints on maintenance priorities

100. The Ethiopian representarive described how the adverse effects of budgetary constraints on maintenance operations can be minimized. In the past the Ethiopian Transport Construction Authority used to prepare two budgets for submission to the Government for approval, one for maintenance expenditure and one for capital expenditure. These budgets were prepared on the basis of the preceding years' budgets, but inevitably the budgets were cut by government, presenting a dilemma on how and where to cut costs. Two approaches were normally tried. Under the first, the periodic maintenance such as regravelling and asphalt surface treatment, was heavily cut back and sometimes deleted altogether. The second approach was to concentrate available funds on the more important roads, leaving the less important roads with virtually no attention. Often a combination of these two approaches was adopted. However it was realized that that way of handling reductions in budget could result in accelerated deterioration of certain roads, and that it made it very difficult for district managers to plan their work programmes effectively. Accordingly, the ETCA management decided to adopt a maintenance management system comprising techniques for:

(i) planning annual maintenance programmes by specific work activities;

(ii) preparing performance-based maintenance budgets;

(iii) allocating resources in accordance with programme needs;

(iv) scheduling and controlling work in ways to ensure the effective accomplishment of the programme.

101. The system had been fully operational nationwide since July 1981 and was improving the way work was managed in several ways. Productivity was improving, priorities were better assessed, appropriate levels of services were being established, and evaluation criteria were being considered. A Monitoring and Evaluation Unit was being set up to determine the cost-effectiveness of specific maintenance and construction operations. The analyses undertaken by that Unit would enable ETCA to predict with more certainty the expected results of maintenance and construction operations.

Ivory Coast, pavement evaluation system

102. The representative of the Ivory Coast described the comprehensive pavement evaluation system employed for the paved roads in the country, which made use of sophisticated pavement monitoring equipment. A road data bank had been set up that included information on the pavements obtained from the measurements together with information on traffic, on the shoulders, drainage, etc. All that information was assessed on a regular basis with respect to each route, in order to predict rate of deterioration of the pavements. "Sondages" might also be made on particular roads to determine the quality and thicknesses of the pavement layers.

Zaire, road maintenance

103. The representative of Zaire described the setting up of the national road authority, and the progress that had been made over the past 10 years. The authority is a parastatal body with a board of directors, and it administers a road system totalling some 45,000 km. The undertaking of road maintenance by contract had been tried with mixed success, and consequently the authority had reverted to the use of direct labour units. The progress of these units is monitored regularly, and labour-intensive techniques are used for many of the maintenance operations. Severe problems are encountered with mechanical equipment and it has proved impossible to standardize on makes because of the diverse sources of donor finance.

Discussion

104. The Nigerian representative expressed concern at hearing that in Zaire the practice of helping local contractors by hiring plant to them had been discontinued and asked whether equipment abuse could be prevented by providing operators with the equipment. The representative of Zaire replied that it had been found that small contractors tended to divert plant to unauthorized use, but that large contractors are still used for doing the bigger jobs. The representative of the Upper Volta referred to the need for better testing and research laboratories in many countries, especially in order to determine how to make better use of local materials. He suggested that neighbouring countries could perhaps share facilities, and wondered whether aid donors might be prepared to support the setting up of such laboratories. The representative of Rwanda raised a similar point. The French representative indicated that the LCPC in France would be happy to test materials at its laboratories, but that the setting up of laboratories was very expensive

and would necessarily fall within the framework of the usual bilateral aid negotiations that take place between donor and recipient governments, and cover aid agreements extending over several years.

105. The representative of Senegal referred to the pavement evaluation programme that his country had practised for many years. The programme was directed towards the drawing up of an annual national road strengthening and maintenance programme. The "old" roads, which did their job well when constructed, then needed strengthening and widening, and each regional engineer prepared his programme for that. The regional plans were welded together into a national plan, and a national programme was formulated, subject to the resources available.

106. The Liberian representative pointed out that parts of his country received up to 360 inches of rainfall a year; that caused the roads to deteriorate very quickly, especially the unpaved roads which represented 80 per cent of the road system. He asked the World Bank representative to clarify a statement made in an earlier session that implied that the World Bank would not be in favour of funding road rehabilitation work in the future. The World Bank representative replied that the Bank wanted to encourage clients to maintain and strengthen roads before they got to the point of needing complete reconstruction, and wanted to avoid the perverse situation that gave incentives to governments to neglect routine maintenance so as to obtain concessionary finance for complete reconstruction when the road failed. However where there was evidence that a road had received reasonable maintenance, but then needed 'heavy' maintenance, the World Bank was prepared to lend finance for it.

107. The Indian representative said that much had been said about systematic maintenance management, and while he agreed with that, he suggested that there was a need to establish a series of norms for the normal maintenance requirements of roads of different kinds in various climatic and geographic regions. He suggested the setting up of an international committee of experts to establish those norms.

108. The Belgian representative raised two questions, but accepted there may be no absolute answers; one was at what level of traffic should an unpaved road be paved, and the other was when should concrete roads be built, as opposed to flexible roads? He realized that local conditions affected those questions fundamentally, but asked participants to bear them in mind in their subsequent deliberations.

Training of trainers in public works (France)

109. The on-the-job training/recycling/upgrading became necessity to improve efficiency in the Directorate of Public Works of African countries. The trainer is the basic conveyor of technical transfer and his own training must enable him to acquire and master new knowledge and technical training.

110. The following 10 roles of the trainer explain well the complexity of the training of trainers:

1. A trainer must first of all be a good technician and an excellent practitioner;

2. A trainer must be a pedagogue;

3. A trainer must know well the organization and type of production his trainees would be involved in;

4. A trainer must be originator of teaching tools;

5. A trainer must be familiar with communications techniques;

6. A trainer must know how to use training techniques;

7. A trainer must know how to develop leaders;

8. A trainer must be a manager;

9. A trainer must be a prime mover of efficiency;

10. A trainer must learn to challenge himself.

111. The need to train and assign specialists to public works services in Africa is considered very important where the demand is great; and hence the need for training of trainers is quite obvious.

A decade of highway maintenance training in Africa-ORT's experience (World ORT Union)

112. Since 1971 ORT has been concerned with highway maintenance training in 14 of the 45 countries in sub-Saharan Africa. Current projects were underway in Burundi, Nigeria, Rwanda, Senegal and Zaire. Past work had been carried out in Chad and the United Republic of Tanzania as well as studies in seven other countries. The paper described ORT's highway maintenance projects and used an analysis of the results to suggest answers to the basic question of what lessons had been learned for the future of highway maintenance training.

113. An analysis of ORT's decade of highway maintenance training in Africa revealed the following as the key areas achieving effective training: manpower plannings, training methods, training facilities. Each of these areas was dealt with in some detail in the paper.

114. Manpower planning was described as the essential framework in which training should take place. An eight-state model for manpower planning was described.

115. Emphasis was put upon the variety of training methods available and the need to select the appropriate method depending on the skill to be developed.

116. A description of training facilities was included.

117. The speaker recommended a more practical orientation to degree courses for civil engineers and especially in their post-graduate professional training.

118. In relation to maintenance by contract, the ORT representative, while welcoming the extension of such methods pointed out that where special training problems would exist, supervisors in ministries would need to be trained in inspection of contractors' work. The staff of the contractors would also need to be trained in commercial management and technical skills.

Effective managers for road maintenance in Africa (ILO)

119. Some of the direct and indirect benefits that accrue from training and development of professional staff were discussed and possible programme formats for its achievement were suggested. It was recommended that those responsible for road maintenance programmes should call for competent advice and assistance to help demonstrate the needs, design the programmes and conduct the training and development efforts required. ILO has recognized the situation and the material it has produced on the basis of experience accumulated through the world, especially designed to meet the needs of management training, was discussed.

Supervision of highway maintenance by contract (IRF)

120. As developing nations look for ways to more effectively utilize limited highway funds the use of highway maintenance contracting is sometimes evaluated as a possible solution. When payment is based on the amount of work accomplished, strong incentives for efficiency are provided.

121. But there are disadvantages to highway maintenance contracting. These include:

- a large government commitment to an existing maintenance organization;
- the absence of a local contracting industry;
- the difficulty of measuring and supervising maintenance activities; and
- the opportunity for collusion.

These disadvantages are very real and must be given serious consideration when evaluating the potential of maintenance by contract.

122. The commitment to the existing maintenance organization can be honoured in countries where the maintenance network is rapidly expanding. In these cases contracting can complement existing forces. Or, a process of attrition can be entered into whereby as workers retire or leave the workforce they are not replaced and contracting is gradually introduced.

123. In countries where no local contracting industry exists the contracting of labour-intensive activities requiring relatively little technical experience can be the instrument through which local contractors are developed.

124. The measurement, supervision and control of maintenance work can be accomplished through proper preparation and planning. A maintenance management system can provide the basis for contracting maintenance in much the same way as design plans and specifications do in construction.

125. In maintenance contracting there is opportunity for collusion between contractors and government employees and between competing contractors, but the danger is no greater than for contracting highway construction.

126. Maintenance by contract is not a panacea but it does provide incentives to improve efficiency: to the contractor because he is paid only for what he produces; the employee because if he does not produce he can be replaced; and to the government because controlling others is easier than self control.

Discussion

127. The representative of France stated that the use of contractors in Africa was not new especially for periodic maintenance. Routine maintenance had been carried out by contract in the Central African Republic, and Mali, the Niger and the Upper Volta had all used contractors for all or part of road maintenance works. The representative of Swaziland said that there was no experience of contract maintenance in southern Africa. It was asked whether all maintenance should be carried out by contract or just periodic maintenance only. Problems were foreseen for the measurement of some recurrent activities such as pothole patching. The use of contractors may reduce the size of the workforce employed and that may be unpopular with Governments and people alike. The representative of IRF replied by saying that, in Brazil, patching outputs were recorded by measuring the volume of materials used at the mixing site. Tight controls were needed at that stage. Works were inspected jointly by both Government officials and the contractor before and after the work was carried out to agree quantities and few difficulties had been encountered. In Argentina, 20 per cent of the maintenance labour force remained in government employment to carry out emergency repairs and to provide a cross-reference on productivities and unit prices being used by contractors. In many cases where maintenance had been carried out by contract, 50 per cent reductions in costs have been obtained.

128. The representative of Burundi suggested that the use of contractors may be appropriate where labour rates are high, but it was believed that in Africa it would be cheaper to carry out maintenance using government staff. That would also help the problem of unemployment. Experiments had been carried out by using international contractors in the Congo, but these had proved more expensive than the local brigades. A further problem was that private contractors were reluctant to work on remote sites. In reply to a question from the representative of the Comoros the ORT representative said that there was a need for the trainer to be selected for his personal qualities, in addition to having considerable experience and being a good communicator. It was expected that besides teaching in the classroom, the instructor would also be responsible for teaching on site. A problem had arisen in Kenya because once contractors had been employed, they became part of the establishment and needed to be kept working. That resulted

in major problems if funds were suddenly cut and caused troubles for the contractors and labour unions alike. In these cases, the government had a responsibility to contractors. In addition to periodic maintenance being carried out by contract, recurrent activities such as grading could also be successful, but there was a problem of lack of expertise among contractors. In Uganda, all sorts of methods had been used to try and reopen roads that had fallen into disrepair. Contractors were asked to price particular jobs that had been identified by the regional engineer. If agreed, work was carried out at that price. Many contractors did not own equipment, but just supplied labour and hand tools. It had been found that payment by quantity for pothole patching was easy to abuse and needed careful supervision. It was recommended that participants should think positively about the use of contractors, but not for all roads. The Mauritania representative said that it was necessary to consider a country's desire to develop a contracting industry. Some countries had a policy for that, others did not.

Equipment management (World Bank)

129. The World Bank representative said that the great road building boom of the 1960s and 1970s threatened to mushroom into the great road maintenance crisis of the 1980s and 1990s. The large networks built up at such great expense over the past decades were aging and were receiving more use - and abuse - than there were ever designed for not only have traffic volumes have often grown more rapidly than anticipated in the design stage, but traffic loadings have also been much heavier, due to widespread violation of legal axle load limits, and routine and periodic maintenance has often been neglected, as the large majority of the vast resources made available for highways in recent years has been absorbed in construction of ever-expanding networks.

130. In much of Africa today the road network is rapidly deteriorating beyond the point where normal maintenance measures can be effective, the degree of deterioration is such that rehabilitation or reconstruction is already or will soon be required for much of the network, at five or ten times more than what it would have cost if simple maintenance and strengthening measures were taken on a more timely basis. The extra costs to the road authorities to reconstruct the network is not sufficient. Increased vehicle operating costs incurred by road users will be an even much larger order of magnitude.

131. Costs of these magnitudes are frightening even to the macro-economist. During the past 25 years African governments have sustained very large investment programme in roads, typically consuming between 20 and 40 per cent of the public investment budget. Such large expenditures on roads have preempted resources and made it necessary to postpone much needed investments in other sectors such as agriculture and industry. With wise management, the proportion of total resources devoted to roads and road transport, or at least the resources per unit of transport output, should have been declining during the 1980s and 1990s and resources freed for investment in other sectors. Poor management in the roads sector with large and rapidly growing backlogs of deferred maintenance, could pose a serious drag on many of the African economies in the year ahead, by sharply increasing the costs of road transportation, and by causing the diversion of further large sums of capital for road rehabilitation and reconstruction which should and could have been avoided.

132. Such dire predictions, and bold assertions were not arrived at casually. They are based on very careful analysis over a long period of time. Shortly after the second African Road Maintenance Conference in Accra in 1977, the World Bank initiated a full-scale review of its experience with maintenance in its highways lending programme all over the world. It considered the problem not only from the economic and financial perspectives, but also from the point of view of public attitudes, institutional development, management, and staffing. The result was a report presented to the World Bank's Board of Directors late in 1981 entitled "The Highway Maintenance Problem" which was subsequently discussed with 18 other bilateral and multilateral aid agencies, and a common statement was adopted on key issues of international finance concerning road maintenance. The final report was published late in 1981, under the title "The Road Maintenance Problem and International Assistance." The report constitutes the official policy statement of the World Bank relative to roads maintenance, and it has been at least informally endorsed by 18 other international aid agencies.

133. Much remained to be done, but is difficult both for the African road authorities and for the international community who would seek to assist Africa. It is going to take determined leadership to solve some fundamentally difficult problems, and one is likely to meet some determined opposition along the way, for there is no way one can accomplish the greater public goods without changing some fixed attitudes and touching on some entrenched interests.

134. What are the options that one would have available to meet the paramount financial needs for road maintenance and strengthening. There are six possible sources for financing improved road maintenance:

(a) Reallocation of resources from other sectors to roads

The large share of public investment budgets devoted to roads during the past 20-25 years is almost certain to decline as claims of other sectors (agriculture, energy, industry, etc.) will be increasingly catered to highways will have to manage with less.

(b) Increase in road user taxes for express purpose of road maintenance

In many countries, road users are already taxed heavily, usually for more than the cost of maintenance. Road taxes are often required to support the general exchequer. Higher taxes on heavier trucks would be desirable (since they cause most of the maintenance costs). These could raise some significant additional revenues in some countries. These taxes should be structured so as to encourage multiple axles for heavy loads.

(c) Reallocation of existing highways budgets from construction to maintenance

At current low levels of interest, economic returns on additional expenditures on maintenance typically exceed 100 per cent per annum. Economic returns to new construction are typically 10-30 per cent. Therefore, only

after the existing network is being well maintained can new additions to the network be economically justified. Yet, in most African countries two to four times as much is being allocated to new construction as to maintenance. This constitutes a major economic distortion. It is the single greatest cause of "The road maintenance problem". Both highway authorities and international aid agencies are guilty of perpetuating this unfortunate situation. Changes in policies of both are required.

(d) Increased local self help

Contribution to services in kind by the local people who benefit most account for at least a large part of the maintenance effort for feeder roads, since central Government funds will be too limited for maintenance of even trunk roads.

(e) Improvements in efficiency and quality control

In many instances, poor quality control in construction and repair works causes premature failure and generates an unnecessary maintenance burden. Expensive equipment fleets are not utilized effectively. Average availability and utilization may be only one-third to one-half of target forms. Large labour forces are not utilized effectively. Too often there is an absence of cost consciousness, a lack of will to base management on efficiency objectives. Possibly this is the second greatest cause of "the road maintenance problem". Several papers at the conference deal with these issues.

(f) International assistance

The World Bank and IDA and some other aid agencies have liberalized (to a degree) their eligibility rules for finance of certain maintenance items, such as:

(i) periodic maintenance which can normally be financed on the same basis as new construction, and

(ii) in exceptional cases, IDA can finance a share (decreasing over time) of the recurrent costs of an expanding maintenance programme.

The World Bank will continue to finance capital items for maintenance. For example: Equipment, workshops, technical assistance and training. However, the World Bank/IDA will be tightening eligibility rules (to a degree) for lending for:

(i) Equipment: Sometimes too much money have been made available for equipment by various donors, thereby diminishing incentives for effective utilization of existing fleets. (The bank will encourage borrowers and other lenders to take stronger measures to improve utilization of existing fleets rather than buy more equipment).

(ii) Road rehabilitation/reconstruction: Timely periodic maintenance and strengthening are by far the most economical methods of capital renewal. In the future, the Bank would normally finance rehabilitation/reconstruction only where reasonable preventive maintenance efforts have been demonstrated.

Labour-based maintenance (World Bank/ILO)

135. The problem of low availability of maintenance equipment were discussed and the World Bank and ILO experience of substituting labour for equipment was outlined. The conclusion had been reached that, for many operations, properly planned and supervised labour-intensive methods provide an alternative to equipment. Quality of finished work can be comparable and, providing labour rates are below about $5 per day, costs are lower.

136. The use of labour for maintenance of the Kenya Rural Access Roads Project was described as an example.

Discussion

137. The representative of Kenya provided more details of the Rural Access Roads Project. The labour intensive approach had proved very appropriate for the routine maintenance of low trafficed roads in those districts where labour was available. Labour-based methods were less suitable for the periodic maintenance of those roads. The representative of the Comoros asked for details of the experience of labour-intensive methods in other countries. The representative of Guinea Bissau described in detail the road system and maintenance methods in that country and said that there was a particular problem of all the maintenance equipment being very old. The road network had deteriorated to a poor state, causing a bottleneck for development and resulting the high foreign exchange expenditure.

Other matters

138. The Director-General designate of the Cairo-Gaborone Trans-East African Highway Authority stated that the Conference had dealt with crucial issue of major concern towards the need of adequate road maintenance both on the financing and management aspects emphasizing the existence of constraints in equal magnitude in both areas. He then posed the question as to what approach would be best to reduce the problem and raised the following issues.

139. Can one solve the road maintenance problem by providing adequate finance without solving the management problems or are the two issues to be tackled concurrently?

140. He also raised a question on the change of attitude in policy of road maintenance financing expressed by the World Bank and asked whether the financing for road maintenance comes as an additional source of fund or is only a matter of giving preference to road maintenance in lieu of road construction and other economic considerations.

141. He expressed the view that if the change of attitude on the lending policy meant giving preference to road maintenance out of a country's allocation, it would be more appropriate for African countries to change their attitude towards road maintenance and provide adequate funds from local sources since road maintenance calls for less foreign exchange than construction and other economic sectors.

142. He said the consequences of not adequately maintaining roads meant:

(a) heavy loss of the construction cost invested;

(b) heavy vehicle operating cost;

(c) heavy cost for rehabilitation; and letting the above to happen means: poor economy; inadequate education and health services; and poverty and starvation.

143. He said that none of the above were acceptable options and stressed that the choice was to adequately maintain the roads constructed. He stated that conferences are valuable tools to exchange experiences, increase awareness to the problems at hand and help to tackle the problems in an organized manner and expressed the view that the present conference had provided considerably valuable materials, clearly indicated the tasks which need to be resolved in the coming years using the appropriate forum to deal with each and every problems of road maintenance.

144. In line with providing the appropriate forum to consolidate the valuable materials made available by the Conference he referred to the Transport and Communications Decade and ECA's role as a prime mover behind the Trans-African highway these had resulted in the establishment of the Lagos-Mombasa Trans-African Highway Authority and the Cairo-Gaborone Trans-East African Highway Authority.

145. He explained that the organizational structures of the two Authorities provided subsidiary bodies as follows:

1. The Inter-State Facilitation Commission
2. The Research Development Committee
3. The Standard Development Committee
4. The Research Development Committee and
5. The National Level Subcommittee

146. He emphasized that to obtain the best possible result out of the valuable materials provided by the conference the need to systematically co-ordinate efforts outside the conference room was obvious. He called attention to the advantages of establishing the subsidiary bodies which existed in the two already established authorities, which dealt with 50,000 km of main and feeder links and covered 30 member and associate member African countries.

147. In conclusion he proposed that participants consider the creation of a task force to consolidate the gains of the Conference.

The Road Maintenance Handbook (Federal Republic of Germany/United Kingdom/France)

148. The background and development of the ECA Handbook was described. Following a resolution at the Second Highway Maintenance Conference in Accra, the sponsoring countries of France, the Federal Republic of Germany and the United Kingdom had joined together to plan the production of a handbook. A circular had been distributed to all African countries and, as a result of comments received, the format and content of the Handbook had been agreed and drafting started.

149. The Federal Republic of Germany was responsible for funding, drafting and printing Volume I on the maintenance of roadside areas, drainage structures and traffic control devices. The United Kingdom was responsible for Volume II on the maintenance of unpaved roads and France was responsible for Volume III on the maintenance of paved roads.

150. Each volume of the Handbook was then introduced and illustrations and examples from the contents were given. Suggestions were made as to how it could be used both as a training tool and to assist the road foreman.

Practical road maintenance handbook: introduction of Volume III (France)

151. Volume III of the handbook deals with the maintenance of paved roads. Although paved roads represent only a small percentage of the road networks of African countries, they cover the most important routes. In view of the considerable investments made in the construction of those roads, they must be maintained.

152. The volume is divided into three parts (separated in the French version) dealing respectively with general repairs, surface dressing and overlays. Overlays are usually handled by contractors, but maintenance teams are also involved especially in the preparatory work.

153. On the whole, the maintenance of paved roads requires more sophisticated methods and materials than the maintenance of other types of roads. That is why the volume contains some basic data especially on nature and properties of aggregates and binders.

Use of the road maintenance handbook as a training tool (Federal Republic of Germany)

154. The Handbook is intended for use throughout Africa. Although a number of specific African conditions were taken into account, the Handbook cannot deal with all the unique conditions of every African country. Additionally, the Handbook's proposals affect the administration and management of road maintenance.

155. These two aspects of working with the Handbook, namely adapting its guidelines to the specific conditions prevailing and bringing road maintenance in line with the requirements given, have to be considered by management when introducing the Handbook.

Use of Road Maintenance Handbook as a reference work and for individual study (France)

156. The primary target groups of the Handbook comprises foremen and supervisors. The complexity of the subjects dealt with in the Handbook, which did not always allow to maintain the simplicity of the text, possible given language comprehension problems and the intention of the Handbook to arouse awareness for more efficient maintenance make it necessary to introduce the target group in the Handbook's use. Consequently, road construction engineers and technicians in African countries should be able to provide their foremen and supervisors with the required assistance in working with the Handbook and to adopt its guidelines to the conditions prevailing as required.

Systematic training in using the Handbook

157. Systematic training of the target group can ensure that qualified personnel knowing how to use the Handbook and motivated to increase the efficiency of road maintenance are available.

158. By the aid of a trainer guide, giving instructions on planning the lessons, also technical experts without comprehensive training experience would conduct the training courses.

Use of the Handbook as text book

159. The Handbook can also be used as a textbook in schools for young people starting their careers; the pupil would have a reference work available upon completion of his training which would be of assistance in his daily work.

160. Conclusion: If a greater efficiency in road maintenance is of interest participants should not simply distribute the Handbook in appropriate numbers among their road construction authorities.

Discussion

161. The representative of ORT expressed his anxiety that the Handbooks should be issued directly to road foremen because of some of the complex words used and long sentences, and also some of the complicated documents. The Handbook should only be issued through road training institutions and should be issued to senior people and then passed down. In the Congo such engineers would see the Handbook before passing it to foremen. The representative of the United Kingdom supported the view that the Handbook should be issued through training institutions. The representative of the Federal Republic of Germany said maintenance costs in Botswana are perhaps not typical because the paved road network is only five years old and

traffic volumes are very low. In the next few years, these maintenance costs may well tend to rise to the same proportions of other countries. The representative of France said that from experience in West and Central Africa, paved roads cost more to maintain than unpaved roads. In response to a request from the representative of Mali for Belgium to carry out certain research on behalf of developing countries, the representative of Belgium said that the OECD report under preparation had found that the maintenance of unpaved roads is cheaper than that of paved roads. The representative of Mauritania said the maintenance cost quoted included bridges at every kilometre over a 150 km length. The representative of Malawi said the cost of unpaved roads can be very high because of inadequate formation. On properly engineered gravel roads, the costs are much lower. It is difficult to understand what these costs meant because of the wide variety of the different types of roads. The representative of the Federal Republic of Germany said the figures quoted represent the costs of road maintenance and not the expenses.

The Maintenance Problems of African Countries

Country paper

162. Nigeria is a vast country with a very large network of roads. An inventory was carried out and maintenance was handed over to the States on an agency basis. This was not successful and the roads were returned to the Federal authority. Because of lack of manpower, decision was taken to maintain by contract. That had been in operation for two years. At first insufficient work was done to prepare specifications and to inspect. Contractors were also inexperienced and ill-equipped. This is now improving but there are still many problems, particularly with personnel. The Federal Ministry is still responsible for maintenance in urban areas and there is hope that trained staff will continue to be provided in future. The experience of maintenance by contract is that contractor must be given guarantee of continued work and must be given large enough piece of work to make it attractive.

163. In Burundi, the smallest and perhaps the most disadvantaged land-locked country in Africa, road maintenance is carried out by the Roads Directorate who perform both routine and periodic maintenance. Recently the government increased the budget for road maintenance and some external funding is also utilized.

164. Mali has locally produced bituminous emulsion which saves on the import of other bituminous products. The best way for donors to help African countries is to listen to the African specialists in their various fields.

165. In Uganda, a land-locked country with a largely rural populations most routine maintenance is carried out by small gangs of labour. The country has problems of shortage of equipment, trained staff and funds. A training school has been established to train both technical and mechanical staff. Salaries have been doubled to try and provide incentives for staff.

166. Botswana has a particular problem of a large area with a very small population. All paved roads have been constructed since independence. The country has a problem of equipment supply which comes from a central government workshop. A costing system for road maintenance is being introduced, the object of which is to rationalize maintenance costing. In Botswana's situation, the maintenance cost of gravel roads is much higher than for paved roads largely because of long-haul distances and shortage of water. The country needed an increase in the maintenance budget over the next few years. In Botswana, no more gravel roads should be built and those existing engineered non-asphalt roads should be paved immediately. The representative of Botswana proposed that forum be established for the exchange of road information in Africa.

167. Togo has a public works authority responsible for the maintenance of all roads. Roads start to deteriorate approximately six years after construction and contractors are given the periodic maintenance work. While maintenance funds come from the general national budget, there is also a road fund.

168. Lesotho, a small country surrounded by South Africa, has a small road network. Before independence, there were only seasonal tracks in the country. No problems have been encountered in financing maintenance in the past, but asphalt paving has been proposed for the future. The high rates of turnover among a large proportion of expatriate staff caused problems. A road maintenance management system was being developed. Most maintenance is carried out by direct labour and a very successful labour intensive maintenance unit responsible for low traffic roads has been set up. In 1977 a National Road Service Campaign was launched to try and initiate self-help schemes, but success was limited by shortages of materials and tools. The country has problems because of split ministrial responsibilities for maintenance, and also because of lack of incentives for staff who then move to the private sector and to other countries.

169. There is also the problem because of donors specifying minimum standards which can cause difficulty when forecasting traffic. There is a need for an international forum in which solutions to the problems of axle loading can be discussed.

170. In Sierra Leone road maintenance is organized by the Ministry of Works and most roads are all weather. Maintenance needs are determined by quarterly inspections. There is a need for a priority rating scheme. There is also scope for international funding for maintenance with the prospect of immediate results. Maintenance development should form part of an integrated development programme.

171. Heavy rainfall in Cameroon causes particularly problems for road maintenance. Everybody complains in the country about road maintenance, but nobody does anything about it. There are several psychological aspects connected with road maintenance which need solving.

172. Ghana 25 years ago had a model road network which, because of lack of maintenance ; was currently in a deplorable state. Other countries should look at Ghana so they can try and avoid making the same mistake. A modern management system is used and training schemes exist. Modern equipment and workshop facilities are available, yet still the roads are deplorable. All the problems discussed in the Conference exist in Ghana, but the worst problem is that of lack of both local and foreign funds. Technical people have little effect on the generation and alteration of resources and the next conference should try and attract people with influence on financial aspects.

173. The representative of Malawi said that in order to prepare conference papers, participants have been forced to think about their problems. Donors have assisted in extending the paved road network which now is a shop window for the country. But maintenance, like justice, must be performed on time if the road network is to remain in good state. Although the country operates an efficient equipment hire scheme which makes users aware of equipment costs, there has been a problem of the supply of spare parts. Labour-intensive methods have been tried and have been successful in some areas of the country but not in others.

174. The representative of Ethiopia noted that this conference had had a problem because participants had dealt more with the issues than with the solutions. In Ethiopia, the road network is inadequate and much of the country remains isolated. Maintenance is carried out by a road authority through district organizations. New maintenance and equipment management systems are being introduced through consultants. There are inadequate funds for equipment and spare parts and one solution to this is the setting up of village self-help schemes. There is a definite need to educate the public and the officials in the importance of maintenance and the problems of axle loading. Attempts are being made to extend the existing training centre. The maintenance problem has not been solved but it is hoped that the right steps are being taken.

175. In Swaziland, a small land-locked country, there is a problem of equipment maintenance and available equipment is only of the order of 50 per cent. Under a sector loan, training activities have been extended. A problem is that additional tasks have to be carried out by the maintenance organization which are not budgeted or programmmed for. There is a problem that maintenance work is dependant on transport and roads far from camps are not well maintained. Experiments have been carried out with labour-intensive methods and these are now being evaluated. The Government is now cutting down on road construction projects to ensure that the present level of maintenance can continue.

176. Senegal has a high traffic density despite having a small population. There has been a large increase in the length of the road network in the past five years. All resurfacing work has been carried out by foreign contractors with local contractors supplying materials. A highway strengthening programme is under way using World Bank funds and training schools have been established. A maintenance management system has also been introduced.

177. Guinea has a particular problem of bridges on laterite roads which are not strong enough to carry the high axle loads. Road signs are also inadequate. There has been considerable erosion and degradation of the earth roads because of the rainfall. Road maintenance organization is decentralized. There is a problem of maintenance materials. The country needs assistance from donors to assist with road maintenance.

178. Rwanda is a small overpopulated land-locked country. A road network is vital to provide access to the sea and roads are the only means of transport. Road construction mechanical workshops are centralized although maintenance work is decentralized. Assistance has been received from several donors. Maintenance suffers from a lack of funds and from a severe topography in addition to being far from the sea. A conference should be organized by ECA for the donor agencies to try and mobilize maintenance funds.

179. Congo's maintenance is controlled by a central institution which hires equipment to regional organizations.

180. Tunisia's maintenance is completely decentralized and funds are allocated directly to regional teams to carry out an agreed programme of works. Substantial increases in funding have been obtained thanks in part to pressure from the media. Periodic maintenance is carried out by private contractors although government does have the equipment to carry this out itself. The workshop facilities are centralized and equipment inspectors travel around the regions to carry out repairs. A cost-accounting procedure has been established for maintenance purposes. There is competition between regions to reduce costs. Donor countries have sent expatriates to assist with training. Provision is made for the training of operators when equipment is purchased. Spare parts provision should be made to meet needs for at least two years. Each individual country must organize its own road maintenance in the way best suited to its own needs. The Conference had provided participants the opportunity to understand the problems of maintenance and each could return to his own country to try to implement some of the suggestions.

181. The Sudan is very dry and the maintenance problem is the encroachment of sand onto the roads. Maintenance is machine intensive. Labour-based methods are not appropriate because of the dry climate and the sparse population. Maintenance force is based at road camps. There are major shortages of qualified staff, equipment and funds.

Conclusion and recommendation

(a) Assessment of the Conference by the World Bank Representative

182. The representative of the World Bank said that it was very difficult to summarize the conference with such wide margins and diverse contributions. Ideally several specialists in the fields of finance, economics, geotechnical, design, organization, management and training were required.

183. There had been an underlying unifying central theme which could be summed up simply as making better use of resources: financial, human, capital and natural resources.

Financial resources

184. The first papers demonstrated that the economic returns from timely maintenance expenditures on the existing network are extremely high:

(a) not merely that timely expenditures on timely maintenance and strengthening can save five to ten fold in subsequent rehabilitation and reconstruction costs;

(b) even more important is the reduction in vehicle operating costs accruing to the road users and the general economy.

185. This type of economic benefit-cost analysis is very helpful in maintenance planning:

- First, in the budget process in establishing how much money should be spent on road construction and maintenance.

- Second, in setting priorities among different categories of expenditures when there is adequate budget allocation, as will be even more the case in future than in the past.

186. Economists would like to have seen more explicit use of economic analysis in quantifying the cost tradeoffs and setting priorities; that topic was treated at some length in the second Conference in Accra in 1977, and at subsequent conferences elsewhere. Those papers are still available from the World Bank.

Human resources

187. One should put consideration of human resources at the beginning of the list and not at the last, for human resource development is the most important problem which we face and it is also true that many mistakes have been made in training projects in the past and any amount of money will not solve road maintenance problems if there are not competent well trained, well experienced and well motivated staff at all levels to make use of the resources.

Manpower planning and development

188. There were several eloquent presentations on human resources development. Surely one should start with the general problem of manpower planning. In order to know where to focus efforts in training and development, one has to have some idea of what one's needs are going to be and what one's existing resources are. Surely these projections are speculative and they will have to be revised and updated regularly, but one simply must have some overall picture. Too often in the past training efforts, at least in World Bank projects, have been too narrowly

focussed, based too much on one target group or another (most often equipment operators and mechanics) and which has left gaps in critical areas, most commonly increases of maintenance management and supervision. But, one should stress, a balanced approach based on better overall manpower planning is what is most needed.

189. Thus the presentations on development of highway managers, on training of trainers and particularly, the enormous effort that has gone into preparation of the ECA Handbook, are all most welcome contributions. In applying the Handbook in African countries, it is however, reiterated, reinforcing the advice expressed by several of the sponsors that giving a man a copy of the Handbook will not turn him overnight into a competent maintenance foreman. Not only is a systematic training effort required, but it is also necessary to look at this Handbook very carefully to determine what changes may be required to adapt it to local conditions. It is certain that the sponsors agree as fully with that observation.

190. The Handbook needed inputs from African road professionals. It is considered ready for trial; no doubt after a few year's experience and help from those in Africa who make use of it, it can be made even better.

Labour-based methods

191. There is another dimension to utilization of human resources and that is the use, in those countries with plentiful labour, of labour-based methods for road construction as well as maintenance. Labour-based methods are no panacea, they will not solve the unemployment problem and there are special difficulties in organizing, managing and monitoring large labour forces. But clearly labour-based technologies can make useful contribution in many countries, as experience in several countries (Kenya, Malawi, Lesotho) most notably-reported at the conference has shown. They are far less dependent on inputs requiring scarce foreign exchange, and thereby are less susceptible to periodic disruption on this account, and free scarce foreign exchange for other needs.

192. The lengthman contractor system of routine maintenance is particularly cost-effective, eliminating the need for a lot of costly and unproductive transport movements of staff and equipment. It is a well proven method having been used historically in most countries and being replaced in Europe and North America only when the costs of labour rose to much higher levels than currently exist in most African economies. Being parttime employment it fits in very well in most rural economies, offering important cash earning opportunities to subsistence farms. It should be stressed however, that the organization should be carefully thought out, and close attention given to the twin issues of supervision and incentives. Without proper incentives (both positive and negative) labour-based methods like equipment can become very inefficient methods and costly.

193. Clearly the presentations given at the conference have shown that there is a cost-effective role for both labour-based methods and equipment intensive methods. But more attention must be given to improving productivities and there must be a concern and will on the part of road authorities to base decisions on efficiency considerations.

Capital resources

194. Consideration of capital resources would define capital in the narrow sense of road equipment. Ethiopian Transport Construction Authority (ETCA) has made and is continuing a very strong effort to implement improved equipment management procedures. ETCA is monitoring equipment availability and utilization very carefully and it should soon have quantitative evidence on the benefits of standardization. Most importantly are the measures ETCA has taken to establish incentives for equipment crews to achieve high utilization and productivity. These stimulate both good equipment and high productivity.

195. Considering the World Bank's paper on the problem of equipment management and the spare parts problem, some of the possible solutions are:

1. Deeper, more comprehensive analysis in every case, comprehending all facts (production requisitions, procurement procedures, customs clearance, warehousing, stock control and distribution);

2. Better prediction of spare requirements which requires better information system;

3. Procurement of spares in several ranches;

4. More adequate financing by the local governments concerned as well as perhaps by the aid agencies.

196. On role of contractors on the use of both human and capital resources there was a lively discussion on the potential role of contractors for routine and periodic maintenance. While not a panacea, and more applicable in some countries than others, experience from several countries showed that contractors, because of certain advantages:

1. their ability to attract and retain good staff

2. the strong incentives for efficiency under unit price type contracts

3. greater freedom from bureaucrat red tape

can play a vital role in some countries. The ideal system may be one in which some maintenance works are done by government while some are done by contractors, with the two different groups put into competition.

Natural resources

197. There are two formal papers and several interventions from the delegates pointing out the importance of the use of local materials. It has been found in several cases that so-called inferior materials could be used very effectively under African conditions. But it was pointed out also that it often required considerable technical expertise and well equipped laboratories to assess the

potential of these materials. Experience in the great laboratories of England and Europe show that a great deal of knowledge about African materials has now been gathered from research over the past one or two decades, but often this knowledge is overlooked in actual practice of road building and maintenance when inappropriate specifications are used so there is first a problem of better dissemination of what is already known. But there is also much that is not yet known and further research on local materials is certainly useful. In some instances the rehabilitation of regional laboratories or strengthening of existing laboratories as would be useful, but that may not always be a wise course.

(b) Draft recommendations

198. The draft recommendations of the conference appear as Annex I to this report.

Date and place of the Fourth African Highway Conference (agenda item 9)

199. The Conference unanimously accepted Tunisia's offer to host the fourth African Highway Conference at Tunisia, before the end of 1985.

Adoption of the report (agenda item 10)

200. The Conference reviewed, made minor observations, and unanimously adopted its report.

Closure of the Conference (agenda item 11)

201. In his closing remarks, the Deputy Executive Secretary of ECA, said he was honoured and pleased to address the closing ceremony of the Conference on behalf of Prof. Adebayo Adedeji, Executive Secretary, who could not be present due to prior commitment elsewhere. The extensive development of highway infrastructure throughout Africa during the last 20 years, although desirable and absolutely necessary for the overall economic development of the region, nevertheless was not adequately supplemented by effective maintenance performance of the existing road network. Reconstruction and rehabilitation of many national highway networks is now required, at a much greater cost.

202. The Deputy Executive Secretary was happy to see the high powered delegations and individuals from the sponsoring nations of Britain, France and the Federal Republic of Germany, the World Bank, the ORT and elsewhere, with a wealth of knowledge and experience, to exchange ideas with an impressive number of representatives of African countries.

203. Although the agenda had provided a variety of issues for discussion in the chronic problem of highway maintenance in Africa, he continued, there was never sufficient time to cover all of the complex issues connected with road transport. It was therefore necessary, he said to meet again and again, not only on maintenance, but also on such other pressing issues as quality control during road construction, the neglect of which contributed immensely towards the maintenance problem, and highway safety programmes, the absence of which contributed to unnecessary deaths and enjuries on the highways of Africa.

204. In conclusion, the Deputy Executive Secretary thanked the sponsors for their technical and financial support, the host Government for its traditional hospitalities and particularly the delegates for their active participation in the Conference.

205. In his statement on behalf of the African participants, the assistant Minister of Public Works of Liberia expressed the warm sentiments and profound appreciation of participants to the host Government and friendly people of Ethiopia for the warm welcome, courtesy and hospitality extended to all delegations, and extended their gratitude to the traditional friendly Governments of France, the Federal Republic of Germany and the United Kingdom for their tireless efforts in providing considerable technical and financial assistance in the organization of a most successful Conference, and in the production of a most valuable maintenance handbook. He also extended his appreciation to the World Bank and the other agencies, organizations and friendly countries and individuals for their valuable contribution. The Conference, he said, had provided a true medium of exchange of ideas regarding the technical, financial and management strategies for planning, programming and executing individual road maintenance operations with a view to protecting African Highway Networks.

206. The efforts of the ECA and the sponsoring Governments in the production of the maintenance handbook was commendable, he said, and it was incumbent upon every African country to fully utilize the Handbook throughout the African region. The need for additional African Highway Maintenance Conferences could not be over-emphasized, and the ECA and friendly Governments needed to continue to provide that medium of exchange.

207. The leader of the delegation of the Federal Republic of Germany said that his Government was happy to have participated in the preparation of the road maintenance handbook and in the organization of the Conference.

208. In this context, he underscored the remarks made by many participants on the importance of road maintenance. He also pointed out that the wish of the engineer was to build new roads but the maintenance of existing roads was also of great importance if such an asset was to be preserved. The same applied to his country where the number of road construction projects was cut down in favour of road maintenance and strengthening work. He was satisfied with the discussions carried out and said that his country would take into consideration any suggestion that could improve the present state of the African road network.

209. Although the Conference which lasted only for three days might have provided all the delegates the opportunity of extensively discussing road maintenance problems he was convinced that the meeting had been a forum for contacts with a view to exchanging experiences, and human contact was always very necessary and essential for solving a good number of problems.

210. The chief delegate of the Federal Republic of Germany then thanked all those who in one way or the other had participated in the organization of the conference which was crowned with success.

211. The representative of the United Kingdom thanked the ECA for organizing a most useful and valuable Conference, and paid particular tribute to the host country, Ethiopia for the efforts they had made to ensure the success of the Conference, for their hospitality, and for providing commendable leadership during the deliberations. He said that participation at the Conference had given him great pleasure not only because of the opportunity the Conference has presented to learn more about the view points of experienced and able African engineers about the road maintenance problem in Africa, but also because of the opportunity provided to meet and review acquaintances with many African friends.

212. As regards the handbook, his organization had enjoyed the task, and had benefited from the close and harmonious relationship with the French and German partners who had prepared the remaining volumes.

213. He hoped that they would be able to continue their support for the multi-national activity in Africa in the future, although that should not be construed to mean a government commitment at that time.

214. He assured the Conference, however, that he and his organization would continue to take keen interest in the road maintenance problem in Africa, and that they (TRRL) intended to continue with all vigour the co-operation effort in that field, which they had had with several African countries. He concluded by wishing every one the best of success in working to improve road maintenance in their own country, with all the benefits, both social and economic, that should flow from the improvement.

215. The representative of the Republic of France said he was honoured to have been given the floor at the closure of this Conference. He thanked, first, the Ethiopian aurhorities for the remarkable welcome accorded to all delegations present at the Conference. He also thanked the officers for having handled the discussions ably and, lastly, thanked the Economic Commission for Africa for the preparation and holding of the Conference.

216. The leader of the French delegation said he was impressed with the competence of the participants, with the high quality of their remarks and the discussions and promised to convey those views to his Government so that it would continue that type of co-operation with African institutions.

217. He acknowledged that some of the resolutions that were adopted concerned the three countries which jointly organized the Conference, namely: France, the United Kingdom and the Federal Republic of Germany.

218. He promised that as soon as he received the final text of the resolutions he would submit it to the French authorities for careful study.

219. He then spoke about the road maintenance handbook jointly prepared by France, the United Kingdom and the Federal Republic of Germany and said he was satisfied with the co-operation that had existed in spite of the distance separating them, the difference in language and traditions; and expressed his strong desire to see that sort of co-operation prevail and improve.

220. He said that the French had put their best into the preparation of the handbook, and that the handbook would be useful.

221. He hoped that they would like, in the next few months, to receive all the remarks of delegates so that the second edition would be a real first-class work.

222. He hoped that participants would send in their comments to enable the production of a second edition soon.

223. In his closing statement, Comrade Kassa Gebre, the Minister of Construction of Socialist Ethiopia said that the Third African Highway Maintenance Conference had provided participants with a thorough understanding of the crucial maintenance problem, and indicated solutions therein which could be applied to other development endeavours in Africa and in the rest of the developing world. The four day Conference had provided participants with the opportunity to examine specific road maintenance problems from the technological, economical, management, manpower training and equipment utilization aspects and to formulate remedial measures that would ensure rational allocation and improved utilization of scarce resources. The ECA, the World Bank and the sponsoring Governments had made commendable efforts in improving African awareness of the worsening road maintenance problems during the past few years.

224. Ethiopia was implementing a new maintenance management system, the Minister continued, with the aim of enhancing management control and operational efficiency. Such steps, he said were useful for an effective road maintenance programme.

225. The Minister of Construction concluded his closing statement by thanking, on behalf of the Provisional Military Government of Socialist Ethiopia and on his own behalf, the ECA, the Governments of the Republic of France, the United Kingdom and the Federal Republic of Germany and all participants, for making the Third African Highway Maintenance Conference a great success. He then declared the Conference closed.

RECOMMENDATIONS

The Third African Highway Maintenance Conference meeting at Addis Ababa, Ethiopia from 20-23 September 1982.

Considering the importance of road maintenance to all African countries,

Noting the concern expressed by the participants as a whole regarding financial constraints, organizational and management problems, equipment and spare parts shortages, and manpower and training needs,

Noting further the high proportion of foreign exchange required in maintenance funding,

1. Recommends that separate funds for road maintenance are earmarked at national and international levels;

2. Requests international agencies and industrialized countries to establish an African fund for road maintenance for the purpose of:

(a) The establishment of at least two training centres in the field of road maintenance;

(b) Providing maintenance equipment;

(c) Supporting road laboratories.

3. Recommends that financial agencies and aid donors provide finance for the maintenance of roads and equipment for at least three (3) years after the construction of the road or the provision of the equipment,

4. Requests aid donors and lending agencies to increase the international finance provided for road maintenance in African countries;

5. Recommends that the construction of roads in future should be submitted to higher standards of quality control to increase the design life;

6. Recommends that African countries co-operate more closely with each other in matters of regional or subregional interest, such as the exchange of research results on all aspects of road maintenance and construction, and sharing the use of expensive pavement evaluation equipment;

7. Recommends that ECA set up a committee of experts to establish standard criteria for road maintenance interventions, taking into account regional conditions;

8. Requests the sponsoring countries to assist ECA in the production of a trainer manual (guide) for the use of trainers responsible for training and maintenance foremen in Africa.

9. Recommends that African countries which have training courses for engineers should consider including in the courses the subjects of road maintenance and maintenance management;

10. Recommends that African countries should take all steps necessary to make attractive the jobs of road maintenance staff at all levels, taking into consideration such matters as career development, renumeration, status, etc.

11. Recommends that the opinion of national users about the appropriate equipment for their countries should be fully taken into account by the international funding agencies.

12. Recommends that international organizations, particularly the ILO extend their studies of labour-intensive operations to several African countries, at least one in each subregion.

13. Recommends that the Fourth African Highway Maintenance Conference is convened by ECA before the end of 1985, and that the resolution of the Third Conference are circulated to participants prior to and at the Fourth Conference.

14. The Conference, expressing further its profound gratitude to the sponsoring nations and the Economic Commission for Africa for preparing the Road Maintenance Manual.

(a) Requests that African countries send back observations on the manual to ECA before the Fourth African Highway Maintenance Conference:

(b) Requests that efforts be made by ECA and the sponsors to translate the Handbook into Portuguese, for the benefit of Portuguese speaking African countries.

LIST OF DOCUMENTS / LISTE DES DOCUMENTS

1. Maintenance Equipment for Bituminous Pavings

2. Effective Managers for Road Maintenance in Africa

3. Note sur l'entretien routier au Togo

4. The Road Maintenance Problem and International Assistance, World Bank / Le problème de l'entretien routier et l'assistance internationale, Banque Mondiale

5. Road Maintenance Handbook, Volume II - Maintenance of Unpaved Roads / Manuel d'entretien des routes, tome II - Entretien des routes non revêtues

6. Road Maintenance Handbook, Volume III - Maintenance of Paved Roads / Manuel d'entretien des routes, tome III - Entretien des routes revêtues

   A. Point à temps

   B. Enduits superficiels

   C. Tapis minces

8. Training of Trainers in Public Works / La formation des formateurs dans les travaux publics

9. Presentation of Volume III of Practical Manual on Road Maintenance / Présentation du tome III du manuel pratique d'entretien des routes

10. Les études d'auscultation des chaussées pour la programmation des travaux d'entretien et de renforcement du réseau routier français

11. Manuel d'exécution de petits ouvrages routiers en Afrique

12. Guide pratique de dimensionnement des chaussées pour les pays tropicaux

13. Manuel sur les comptages routiers et les enquêtes de trafic

14. Entretien mécanique des routes en terre en Côte d'Ivoire

15. Traité pratique des bacs

16. Les métiers de l'entretien routier

17. Quelques aspects de la tenue des ouvrages en terre et de leur amélioration

18. Manuel sur les routes dans les zones tropicales et désertiques :

   Tome I - Conception et économie des projets routiers

   Tome II - Etudes et construction

   Tome III - Entretien et exploitation de la route

19. Maintenance Management for District Engineers (TRRL Overseas Road Note 1) / Gestion de l'entretien routier à l'intention des ingénieurs régionaux (Note du service d'Outre-Mer de TRRL N° 1)

20. Maintenance Techniques for District Engineers (TRRL Overseas Road Note 2)

21. Use of the "Road Maintenance Handbook" as a Training Tool

22. Methods for the Determination of Road Maintenance Priorities / Methodes pour la détermination des priorités d'entretien routier

23. Increase in the Economy of Road Maintenance Efforts by Using Local Road Materials / Augmentation de la rentabilité de l'entretien routier par l'utilisation de materiaux locaux

24. "Handbook - Purpose, History, Elaboration"

25. Road Network Maintenance and its Impact on Staffing, Equipment and Running Costs Requirements for Highway Authorities

26. Road Maintenance Handbook - Volume I - Maintenance of Roadside Areas, Drainage Structures and Traffic Control Devices / Manuel d'entretien des routes - Tome I, Entretien des abords, des ouvrages de drainage et de la signalisation

27. Organisation of Road Maintenance Services

28. Pavement Conditions Surveys for Programming Maintenance and Strengthening Work on French Road System

29. A Decade of Highway Maintenance Training in Africa

30. Supervision of Highway Maintenance Contracting Operations

31. Management Problems of Road Maintenance Projects

32. Cost Accounting for Road Maintenance

33. Maintenance of Arterial Roads in India

34. Increase in the Economy of Road Maintenance

35. The Effect of Budget and Other Constraints on Maintenance Priorities

36. Road Maintenance Management System in Ethiopia

37. Equipment and Spareparts Management in Ethiopia

38. How can we reduce the Cost of Road Maintenance and Stretch Available Funds

39. Maintenance - Rural Roads: A Proposed Methodology and Organization

40. Source of Finance for Maintenance of Roads in Ethiopia